Depleted uranium: Hearing a different drummer

Jean-François GERVAIS
AREVA
Front End Business Group
Vice-President Business Optimization

Waste Management Conference – March 2011 – Phoenix, AZ

AREVA

What are we talking about ?

- **Depleted uranium inventory (outside of USA)**

Country	Quantity of Depleted Uranium (tU)
Russia	680 000 – 700 000
France	260 000
Germany	80 000 – 85 000
UK	
Netherlands	

AREVA

Physical form of intermediary storage

- **France developed a defluorination process in the 1980s and, since then, is converting on line its depleted UF_6 into U_3O_8**
- **Meanwhile, other countries were storing their depleted UF_6**
- **Lately, all of them moved to more stable forms of storage**
  - **Russia**
    - Conversion to UF_4 at Angarsk (project Cedar)
    - Conversion to U_3O_8 at Zhelenogorsk (using AREVA's technology)
  - **UK: Conversion to U_3O_8 (project in progress using AREVA's technology)**
  - **Germany and Netherlands: conversion to U_3O_8 sub-contracted to AREVA**

AREVA

Focus on the French situation
Technical status

- Depleted UF_6 coming from EURODIF is de-fluorinated into U_3O_8 in the W facility at Pierrelatte
- AREVA U_3O_8 is conditioned in containers of 10 MT capacity and stored on two sites in France.
- Containers are piled up, either in dedicated depleted uranium storage facilities or as radiation shielding in reprocessed uranium storage facilities.

AREVA

Depleted uranium: legal status

- **In all european countries and in Russia, depleted uranium is not considered as a waste as long as there are possibilities for re-use**

- **In general, it is the responsability of the industrial owner of depleted uranium to decide if a resource or a waste**

- **The French « Environmental Code » says, in the article L542-1-1**

  […]

  A radioactive material is a radioactive substance for which further use is forecast or contemplated, after treatment if need be.

  […]

  Radioactive waste is a radioactive substance for which no further use is forecast or contemplated.

  […]

AREVA

Utilization of depleted uranium

- **Current utilization**
  - **Radiological shielding in RepU storage facilities**
  - **MOX fuel fabrication for LWR**
    - more than 100 tU per year
- **Present and mid-term utilization**
  - **Re-enrichment of tails**
    - Recent program based on gaseous diffusion enrichment technology : READ
- **Long term utilization**
  - **Fast neutrons reactor fuel**

AREVA

Re-enrichment of depleted uranium
AREVA experience – The READ Campaign

- **Campaign launched in 2008 with objective to re-enrich 15,000 tU of depleted uranium into LEU**
- **Technical success**
- **Campaign stopped early 2009 at 7,800 tU because of dropping price of natural Uranium**

AREVA

Re-enrichment of depleted uranium Lessons learned

- **Conditions for future re-enrichment**
  - **Sustainable price for natural uranium: the trend seems right**
  - **availability of enrichment capacity**
  - **ability to lower the secondary tails assay will increase the share of depleted U eligible for re-enrichment**
  - **having the richest tails under the right form**
    - re-conversion from U_3O_8 to UF_6 represents a significant part of the re-enrichment cost

“Richest tails should be kept as UF6”

AREVA

Fuel for fast neutrons reactors

- **Worldwide renewed interest for fast neutrons reactors**
  - **Prototype Fast Breeder Reactor (PFBR) in India**
  - **BN800 in Russia**
  - **ASTRID in France**
  - **PRISM in the USA…**
  - **and work ongoing in Japan**
- **A strategic inventory**
  - **Today's French inventory of depleted uranium can feed for more than 300 years the FBR componant of its future nuclear fleet (assumed to be 20%)**

Present intermediate storage options are acceptable for such an horizon

AREVA

Conclusion (1/3)

- **In the past decades, most countries considered depleted uranium as a valuable resource for the next generation of reactors, at a distant horizon requiring several decades of intermediate storage**

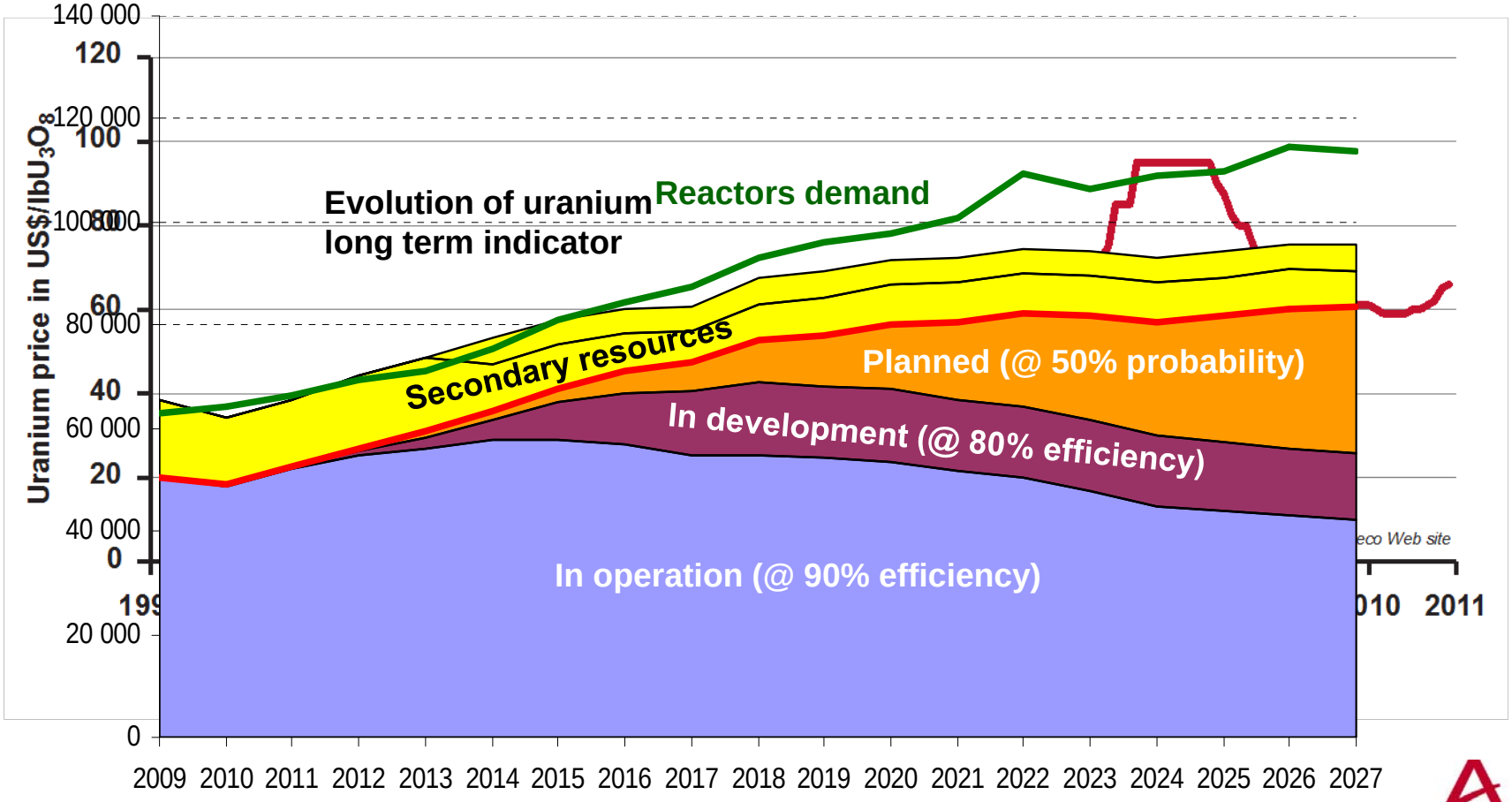
- **Status of depleted uranium and storage policies have been defined accordingly**

AREVA

Conclusion (2/3)

- **But the world is changing**

Annual Uranium production



Conclusion (3/3)

- **The nuclear renaissance triggered a durable increase of price of uranium, and even some concerns about its future availability**
- **Lowering of tails assays in new enrichment facilities will increase the spectrum of historical depleted uranium eligible for re-enrichment**
- **This evolution has changed the horizon for re-utilization of depleted uranium**

“Status and storage policies should be revisited accordingly”

AREVA

Thank you for your attention